

## **FAULT REPORT**

**RMD # 03928 (10-19-2003)**

**Subsystem: Beamline 10-ID (cryogenic)**

**Submitted by:** R. Dortwegt (10-24-2003)

### **DESCRIPTION OF FAULT(S)**

Pressure of high pressure loop of cryocooler going out of control while high pressure buffer was being filled.

### **DISCUSSION, RESPONSE TIME AND TIMELINE**

High-pressure loop of cryocooler had been requiring periodic filling on an approximately weekly basis. However, the User filled the loop on Friday, 10-17-03 and filling was again required on the 19<sup>th</sup>, indicating unexpectedly high LN2 usage. When User began to fill the system on the 19<sup>th</sup>, the pressure indicator in the high-pressure buffer began to rise uncontrollably. User decided to stop the filling operation and vent high-pressure loop. Pressure setpoint for high-pressure loop was lowered to zero (normal setpoint is 20-22 psig). Pump operation was continued, but beam was stopped to prevent possible damage to monochromator.

The User took this action prior to 2:00AM on the 19<sup>th</sup>.

D. Burke and R. Dortwegt responded to the call-in by the floor coordinator (D. Wyncott). Arrival time was approximately 3:00AM.

### **REMEDIATION (HOW THE PROBLEM WAS SOLVED)**

The User tried to demonstrate the uncontrollable pressure situation by raising the setpoint of the high-pressure loop to 20psig. Upon doing this, the pressure appeared to be controlling normally. It was decided to try to operate the cryocooler again per normal procedures. The high-pressure buffer was filled by the ASD technician.

The cooler was filled successfully and operated normally. No remedial action was taken.

### **REASON FOR THE INCIDENT**

The actual cause of the fault cannot be determined conclusively because the fault could not be reproduced.

The most likely explanation for the event concerns the fact that the LN2 transfer line which supplies product to the system is not continually circulated or kept cold. The liquid in this line would have been stagnant for a period in excess of 48 hours. The liquid

in the line would have been “warm” and, as a result, at a saturated pressure higher than the 20 psig in the buffer. If the liquid product in the transfer line were even as little as 50°F higher than atmospheric LN2, the pressure in the line would have been in excess of 100psig. When liquid is transferred to the buffer, the transfer line must first be cooled so that the pressure and temperature of the transferred liquid is reduced to around the atmospheric boiling point prior to admission to the system. If the transfer line was not pre-cooled (or not pre-cooled enough), the pressure in the buffer would likely have risen seemingly uncontrollably and nothing could have been done to alleviate the situation short of stopping the fill. The buffer was protected by the system relief valve as well as a rupture disk, so equipment and personnel safety was not an issue.

## **APPLICABLE PROCEDURES**

The User has a hand-written copy of a fill procedure which is found at the end of this report. Procedures are also available in the manufacturer’s manual.

## **SPARES**

No spares were needed.

## **SYSTEM MONITORING**

This event illustrated the benefits of a pro-active monitoring effort by ASD-ME technicians on a regular basis. Such a monitoring plan is under consideration pending response by Users after such a program is planned and worked out.

## **CORRECTIVE ACTION**

No corrective action was required to put the system back into operation successfully.

Filling procedures will be discussed with the User. Filling procedures must be reviewed and compared with those documented by the manufacturer (Oxford). It should be noted that filling of the high-pressure loop is covered by the manufacturer’s manual, but only as part of the initial operation procedure and not as a separate step should the high-pressure loop require topping off. Furthermore, the aspect of cooling the inlet transfer line if it is warm is not discussed in the manufacturer’s manual.

A filling procedure must be developed for the situation covering the need to fill after the system has already been operating for a time after its initial cool-down.

refilling the cryopump LN2 buffer:

buffer should never be below 55 %

if it is, do the following

PROCEDURE FROM  
10-ID  
10-19-2003

1.) set setpoint of cryopump heater to 0

- push "inlet"
- push "v"
- push "enter"

2.) pull level meter (S3) out until it clicks

3.) open the upper relief valve (brass tubing, has handwritten label on it)

wait until liquid comes out,  
then close it again

4.) close V4 (low pressure fill)

5.) open V3 (high pressure fill)

open V6 <sup>blue handle</sup> vessel valve,  
yellow tube liquid should come out

6.) fill buffer to approximately 100%

7.) close V6, V3

8.) open V4

9.) put S3 back in place

10.) set cryopump heater back to ~~18.6~~ 18.6